SHORT COMMUNICATION

A MECHANICAL DESTONER FOR SMALL PROCESSING PLANTS

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Abstract

A mechanical destoner was designed and built. The unit is suitable for small scale potato processing. It efficiently removes all stones from potatoes while rejecting less than 1% of the potatoes.

Introduction

Stones are present in some potato fields and frequently show up with the harvested potatoes. If the stones are not removed before the potatoes go to a process line, these stones can cause considerable damage to equipment. This damage occurs most often at the cutters. The stones destroy cutter blades and can do extensive damage to the cutter's drive components, *e.g.*, gears.

In commercial plants, these stones are removed by water flumes or centrifugal, hydraulic separators. For small scale potato processing, *e.g.*, in a pilot plant, we have found these destoners impractical. Normally small scale processing lines will not have a large volume, high velocity flume for transporting potatoes. Although destoning is necessary, the addition of a commercial system for destoning alone is a great waste of energy, money and utilities. A mechanical destoner is more practical. Large commercial processes perform destoning at the inlet to the process. We chose to remove the stones just before the cutter since it was convenient to add the destoner to the cutter feed conveyor. The objective of this study was to develop a functional mechanical destoner for small scale processing.

Materials and Methods

The destoner was used in our pilot plant potato flake process line. The potatoes were peeled in a pilot model steam peeler (type DSA45, Paul Kunz and Company, Döttesfeld, West Germany),* subjected to a steam pressure of 1.3×10^6Pa for 18 sec and then passed through a series of high pressure (5.5×10^5Pa) tap water sprays in a rod/reel washer to remove the loosened peels. The peeled potatoes were transported from the washer to the cutter with a conveyor. (This is the conveyor we modified into a destoner). The potatoes then went to an Urschel cutter (model G-A, Urschel Laboratories,

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Valparaiso, IN).* The remaining major unit operations in the process were precooking, cooling, cooking, ricing, and drum drying as detailed in Sullivan (1).

Figure 1 is a schematic drawing of the destoner installation. In operation, potatoes may either drop by gravity or be conveyed to the destoner in rows in a single layer. Conveying can be accomplished conveniently by a paddle wheel or a flight conveyor depending on the elevation of the process equipment before and after the destoner. In our particular installation the potatoes were conveyed to the destoner by a flight conveyor at a speed of 0.5 m/sec.

Assisted by centrifugal force and gravity, the potatoes are discharged from this conveyor at a point past its apex. The velocity of the potatoes is adequate to impale them on the destoner needles. There are 132 needles mounted radially on a cylinder, one needle per 6.45 cm^2. Fabricated from an 18-8 stainless steel, they are 2.06 cm long with good strength provided by tapering diameters from .32 cm to .03 cm. The tangential velocity of the needles at their tips is about 0.3 m/sec. It must not be too high or the combination of gravity and centrifugal force will act to eject the potatoes prematurely. The potatoes are rotated approximately 210° before a stationary comb forces the potatoes from the needles. The potatoes drop by gravity into the feed hopper of the cutter.

When a stone strikes the destoner from the flight conveyor, it does not get impaled on the needles. It remains on the tips of the needles and, as depicted in Figure 1, drops off and into the stone collection trough.

Results and Discussion

To test the destoner, we processed potatoes through the unit and added stones previously discovered in potatoes. Each stone was rejected each time it was mixed with the potatoes. The destoner occasionally rejects a potato as a stone when the potato feed rate is too high. Potatoes saturate the unit and additional potatoes bounce off potatoes already impaled on the needles. Increasing the speed of the shaft/needles will not increase destoning capacity because the increased centrifugal force rejects impaled potatoes. Occasionally potato pieces that fit between the needles are rejected when they bounce off the shaft similar to stones bouncing off the needles. In a measured test with 1500 kg of potatoes at a processing rate of 200 kg/hr, 12.7 kg of peeled potatoes (0.9%) were rejected. Many of these were potato pieces, broken during the peeling operation. Installing the destoner ahead of the peeling operation, but after washing, might lower the rejection rate even further and additionally prevent possible damage to the peeler.

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*Reference to brand or firm name does not constitute endorsement by the U.S. Department of Agriculture over others of a similar nature not mentioned.

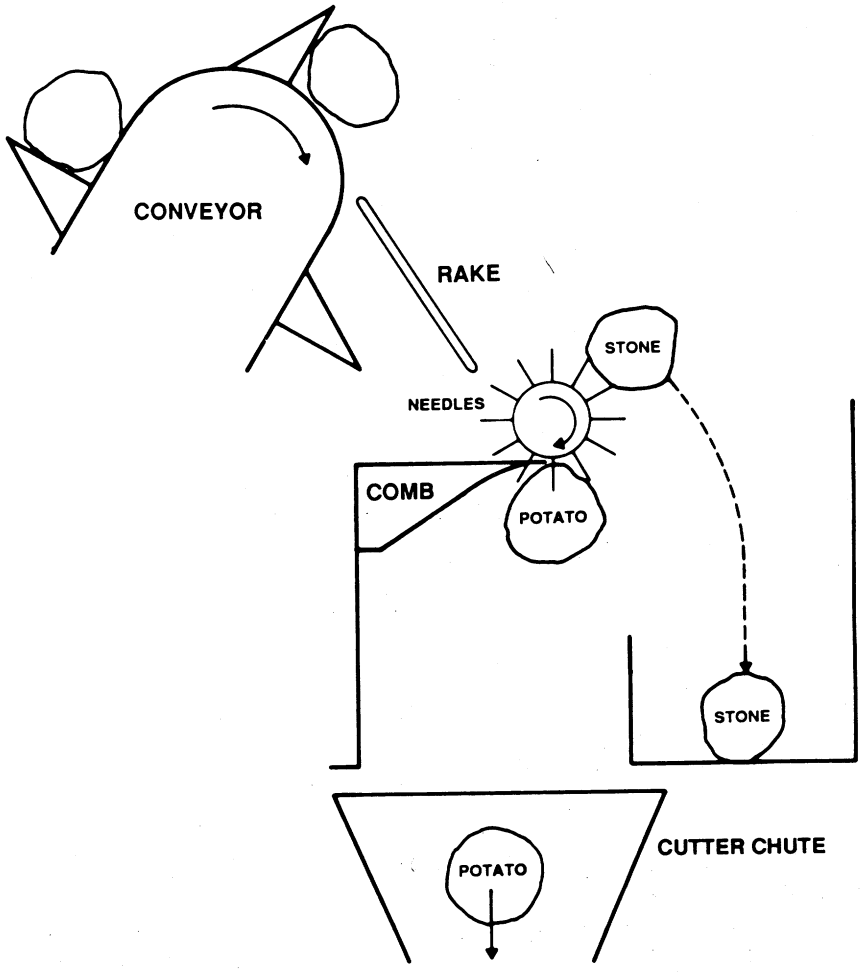

FIG 1. Operating principle of a mechanical destoner for small processing plants.

In time the collection trough gets full of rejected stones and potatoes. Therefore, we plan to make a slight modification to our unit by sloping the trough to one side. The rejects can then be inspected occasionally and any potatoes reintroduced to the cutter. The needle spacing of our destoner worked well with the size of the potatoes processed. For the processing of small potatoes (or other commodities) a different needle spacing might be desirable. The small holes produced by the needle penetrations are obviously no problem in the production of potato flakes. In our opinion this is also true

for the processing of other potato products. In the processing of French fries, some processors may consider the penetrations a small aesthetic problem.

Fully detailed fabrication drawings can be obtained by contacting the authors.

Literature Cited

1. Sullivan, J.F., M.F. Kozempel, M.J. Egoville and E.A. Talley. 1985. Loss of amino acids and water soluble vitamins during potato processing. Food Sci J 50(5):1249-1253.